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The impact of the Messinian Salinity Crisis on marine biota

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The Messinian Salinity Crisis (MSC) was the greatest paleoenvironmental perturbation the Mediterranean has ever seen. The literature is abundant in hypotheses on the repercussions of the MSC on organisms. However, all these are based on incomplete and still uncertain scenarios about the MSC evolution, as well as on the assumption that such a paleoenvironmental perturbation must have completely reset marine biota. Having prevailed for many decades now, this assumption has leaked from paleontology and geosciences to biological sciences, with numerous studies taking this scenario for granted instead of using it as a starting hypothesis to be tested. Here, we review and revise the marine fossil record across the Mediterranean from the Tortonian until the Zanclean to follow the current rules of nomenclature, correct misidentifications, and control for stratigraphic misplacements. We examine the composition of marine faunas, both taxonomically and considering the function of each group in the marine ecosystem and the transfer of energy through the marine food web. Specifically, we investigate the following functional groups: 1) primary producers, 2) secondary producers, 3) primary consumers, 4) secondary consumers, and 5) top predators. Our study includes sea grasses, phytoplankton, corals, benthic and planktonic foraminifera, bivalves, gastropods, brachiopods, echinoids, bryozoans, fishes, ostracods, and marine mammals. We calculate biodiversity indexes to provide independent evidence quantifying to what degree the marine fauna underwent:

- A drop of overall regional biodiversity of the Mediterranean due to environmental stress during the Messinian.
- A taxonomic and functional change between the Tortonian, Messinian, and the Zanclean, that is before and after the MSC, as well as during the precursor events to that actual crisis taking place after the Tortonian/Messinian boundary.
- The onset of the present-day west-to-east decreasing gradient in species richness, which has been related to the sea temperature and productivity gradients and the distance from the Gibraltar connection to the Atlantic.